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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/817,193

04/02/2004

Anna M. Minvielle

H1624

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45305 7590 09/06/2007  
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EXAMINER

RAYMOND, BRITTANY L

ART UNIT

PAPER NUMBER

1756

MAIL DATE

DELIVERY MODE

09/06/2007

PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

<b>Office Action Summary</b>	<b>Application No.</b> 10/817,193	<b>Applicant(s)</b> MINVIELLE ET AL.	
	<b>Examiner</b> Brittany Raymond	<b>Art Unit</b> 1756	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

#### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

#### Status

- 1) ☒ Responsive to communication(s) filed on 28 June 2007.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

#### Disposition of Claims

- 4) ☒ Claim(s) 1-13, 15 and 16 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-13, 15 and 16 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

#### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 02 April 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

#### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

#### Attachment(s)

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)                                | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                       | 5) <input type="checkbox"/> Notice of Informal Patent Application                       |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)<br>Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____  |

**DETAILED ACTION**

***Claim Rejections - 35 USC § 102***

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

2. Claim 1 is rejected under 35 U.S.C. 102(b) as being anticipated by Wang (U.S. Patent 6261727).

Wang discloses a process for patterning a substrate comprising: forming contact holes in a photoresist layer that consist of both isolated and densely packed contact holes, and etching this pattern into the substrate located below the photoresist layer (Column 3, Lines 15-19), as recited in claim 1 of the present invention. Wang also discloses that the contact holes of each type are spaced appropriately, with one being spaced farther apart than the other (Column 4, Lines 12-17), as recited in claim 1 of the present invention. Wang discloses that a quadrupole filter is used to transmit light through a reticle having a pattern to be imaged onto the photoresist layer (Column 3-4, Lines 66-67, 1-10). The examiner is considering a quadrupole filter to be equivalent to two dipole filters placed together. Wang states that the quadrupole filter is arranged so that it works for horizontal and vertical arrays of the contact holes (Column 4, Lines 63-64), as recited in claim 1 of the present invention.

Wang teaches every limitation of claim 1 of the present invention and thus anticipates the claims.

***Claim Rejections - 35 USC § 103***

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

4. Claims 2, 3, 5, 6, 9, 10, 12 and 13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wang (U.S. Patent 6261727) in view of Wang (U.S. Patent Publication 2004/0229135).

The teachings of Wang ('727) have been discussed in paragraph 2 above. Wang ('727) also teaches that the regularly spaced contact holes are separated by about 180-360 nm (Column 4, Lines 15-17), as recited in claim 6 of the present invention. Wang ('727) states that the illumination filter can include annular sectors (Column 4, Lines 53-54), as recited in claim 12 of the present invention. Finally, Wang ('727) discloses that the process uses a single exposure step (Column 3, Line 17), as recited in claim 9 of the present invention. This means that the apertures are exposed simultaneously, as recited in claim 10 of the present invention.

Wang ('727) fails to disclose that the first dipole aperture and second dipole aperture have at least one of different sizes or different spacings.

Wang ('135) discloses the use of a quadrupole illumination for exposing grid patterns onto a substrate. Wang ('135) states that the poles of the quadrupole illumination are placed on the x and y axes with distances determined by  $p_x$  and  $p_y$  (Paragraph 0030), which can be different from one another (Paragraph 0037), as recited in claims 2 and 13 of the present invention.

Wang ('727) teaches every limitation of claims 3 and 5 of the present invention in paragraph 2 above.

It would have been obvious to one of ordinary skill in the art, at the time of invention by applicant, to have spaced the two apertures of a quadrupole differently from one another, as suggested by Wang ('135), in the process of Wang ('727) because Wang ('135) teaches that this allows for a more accurate illumination of the mask containing the patterns to be formed on a substrate.

5. Claims 4 and 11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wang (U.S. Patent 6261727) in view of Wang (U.S. Patent Publication 2004/0229135), as applied to claims 2, 3, 5, 6, 9, 10, 12 and 13 above, and further in view of Socha (U.S. Patent Application 2002/0152452).

The teachings of Wang ('727) and Wang ('135) have been discussed in paragraphs 2 and 4 above.

Wang ('727) and Wang ('135) fail to disclose the equations used for finding the aperture spacing and that a binary mask is used.

Socha discloses a mathematical model for imaging a pattern onto a substrate comprising the use of the equations in Figure 1 to determine spacing between features of an illumination system, as recited in claim 4 of the present invention. Socha also discloses that typical mask types used to transfer patterns onto a substrate are binary, alternating phase shift and attenuated phase shift masks (Paragraph 0007), as recited in claim 11 of the present invention.

It would have been obvious to one of ordinary skill in this art, at the time of invention by applicant, to have used the equations suggested by Socha in the process of Wang ('727) and Wang ('135) because Socha teaches that these equations are used in order to align the illumination system correctly so that the substrate can be patterned correctly and efficiently. It also would have been obvious to have used a binary mask, as suggested by Socha, because Socha teaches that this type of mask is normally used in this type of a process.

6. Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over Wang (U.S. Patent 6261727) in view of Wang (U.S. Patent Publication 2004/0229135), as applied to claims 2, 3, 5, 6, 9, 10, 12 and 13 above, and further in view of Tanaka (U.S. Patent Application 2003/0207521).

The teachings of Wang ('727) and Wang ('135) have been discussed in paragraphs 2 and 4 above.

Wang ('727) and Wang ('135) fail to disclose the diameter of regularly spaced contact holes.

Tanaka discloses a photolithographic method comprising the formation of contact holes, with diameters of 150 nanometers, on a photoresist layer (Paragraph 0200), as recited in claim 7 of the present invention.

It would have been obvious to one of ordinary skill in this art, at the time of invention by applicant, to have used the diameter of contact holes, as suggested by Tanaka, in the process of Wang ('727) and Wang ('135) because Tanaka teaches that typical diameters of contact holes, in this type of process, fall within a range around this number.

7. Claims 8 and 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wang (U.S. Patent 6261727) in view of Wang (U.S. Patent Publication 2004/0229135), as applied to claims 2, 3, 5, 6, 9, 10, 12 and 13 above, and further in view of Kawashima (U.S. Patent Application 2004/0057036).

The teachings of Wang ('727) and Wang ('135) have been discussed in paragraphs 2 and 4 above.

Wang ('727) and Wang ('135) fail to disclose the pitch between semi-isolated contact holes and that a plurality of irregularly spaced contact holes are illuminated onto a periphery region of the substrate by a low sigma illumination source through a second mask.

Kawashima discloses an exposure method comprising illuminating a contact hole pattern onto a substrate with the hole pitch in a lateral direction being 180 nm and the hole pitch in a longitudinal direction being 360 nm (Paragraph 0099), as recited in claim 8 of the present invention. Kawashima also discloses that when a small sigma

illumination is used, the beams can be diffracted from the normal area on the substrate (Paragraph 0082), which could be the periphery of the substrate, as recited in claim 15 of the present invention. I would be obvious to one of ordinary skill in this art to provide a second mask with a different pattern in order to produce the irregularly spaced contact holes, as recited in claim 15 of the present invention.

It would have been obvious to one of ordinary skill in this art, at the time of invention by applicant, to have used the pitch, as suggested by Kawashima, in the process of Wang ('727) and Wang ('135) because Kawashima teaches that there can be a pitch within this range in this type of process. It also would have been obvious to use a low sigma illumination source, as suggested by Kawashima because Kawashima teaches that this type of illumination allows patterns to be illuminated onto other portions of the substrate that are not usually patterned.

8. Claim 16 is rejected under 35 U.S.C. 103(a) as being unpatentable over Wang (U.S. Patent 6261727) in view of Wang (U.S. Patent Publication 2004/0229135) and Kawashima (U.S. Patent Application 2004/0057036), as applied to claims 2, 3, 5, 6, 9, 10, 12, 13 and 15 above, and further in view of Socha (U.S. Patent Application 2002/0152452).

The teachings of Wang ('727), Wang ('135) and Kawashima have been discussed in paragraphs 2, 4 and 7 above.

Wang ('727), Wang ('135) and Kawashima fail to disclose that the second mask is a six percent attenuated phase shift mask.



Socha discloses that typical mask types used to transfer patterns onto a substrate are binary, alternating phase shift and attenuated phase shift masks (Paragraph 0007), as recited in claim 16 of the present invention

It would have been obvious to one of ordinary skill in this art, at the time of invention by applicant, to have used a type of attenuated phase shift mask, as suggested by Socha, in the processes of Wang ('727), Wang ('135) and Kawashima because Socha teaches that this type of mask is normally used in the type of photolithographic process disclosed in the present invention.

### ***Response to Arguments***

9. Applicant's arguments, filed 6/28/2007, with respect to the rejection of claim 1, have been fully considered but they are not persuasive.

Claim 1 does not teach that the first and second dipole apertures have different spacings. It only reads that they are oriented to match the contact hole mask pattern, which Wang ('727) teaches.

10. Applicant's arguments, filed 6/28/2007, with respect to the rejection(s) of claim(s) 2-13, 15 and 16 have been fully considered and are persuasive. Therefore, the rejection has been withdrawn. However, upon further consideration, a new ground(s) of rejection is made in view of a newly found prior art reference.

The reference, Wang ('135), has been added to the rejection to teach that a quadrupole can have different spacings between the two sets of dipole apertures. There is no statement in Wang ('135) that the quadrupole is equally spaced. Wang

('135) only states that the quadrupole is spaced according to the grid pitches of the mask pattern and that the two grid pitches can be different from one another.

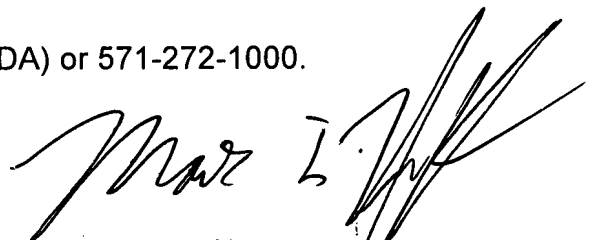
***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Brittany Raymond whose telephone number is 571-272-6545. The examiner can normally be reached on Monday through Friday, 8:00 a.m. - 4:30 p.m. EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mark Huff can be reached on 571-272-1385. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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